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Changes in the composition and properties of Ashalchinskoye bitumen-saturated sandstones when exposed to water vapor

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2018 Institute of Physics Publishing. All rights reserved. Ashalchinskoye bitumen deposit is an experimental platform for testing technology of high-viscosity oil extraction from reservoir rocks. Last time for enhanced of oil recovery in reservoir used pressurization a water vapor with a temperature of ~ 180 C (SAGD technology). However, what happens in sandstone reservoir is little known. We did a study of the effects of water vapor on the structural components of bitumen saturated sandstone. In paper were studied the rock samples at base condition and after one week exposure by water vapour. The thermal analysis showed that steaming helps to removes light and middle oil fractions with a boiling point up to 360 C from oil saturated sandstones. Content of heavy oil fractions virtually unchanged. Studying the composition of water extractions of samples showed that the process of aquathermolysis of oil is accompanied by a lowering of the pH of the pore solution from 7.4 to 6.5 and rise content in several times of mobile cations Ca2+, Mg2+ and HCO3-, SO42- anions. Follows from this that the thermal steam effect by bitumen saturated sandstones leads to partial oxidation of hydrocarbons with to form a carbon dioxide. The source of sulfate ions were oxidized pyrite aggregates. Due to the increasing acidity of condensed water, which fills the pore space of samples, pore fluid becomes aggressive to calcite and dolomite cement of bitumen saturated sandstones. As a result of the dissolution of carbonate cement the pore fluid enriched by calcium and magnesium cations. Clearly, that the process is accompanied by reduction of contact strength between fragments of minerals and rocks. Resulting part of compounds is separated from the outer side of samples and falls to bottom of water vapor container. Decreasing the amount of calcite and dolomite anions in samples in a steam-treated influence is confirmed by X-Ray analysis. X-Ray analysis data of study adscititious component of rocks showed that when influenced of water vapor to bitumen saturated sandstones there are the processes of transformation of clay minerals. Mixed-illite-montmorillonite phase is primarily exposed to changes. In this case we fix initial stage of the destruction of polycrystalline particles mixed-mineral. Reducing the size of clay minerals particles along the normal to the layers (L001) is the result from lower energy costs of delamination and disintegration the crystallites along this direction, in comparison with others. Thus, using of SAGD technology at exploitation of Ashalchinskoye bitumen saturated reservoir will be followed by acidification of the pore fluid, activation processes of dissolution calcite cement and transformation of mixed-layers clays minerals.

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